REMARKS

Claims 36-108 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-26 of U.S. Patent No. 6,606,153. Attached is a Terminal Disclaimer referring to Patent No. 6,606,153. The obviousness-type double patenting rejection is therefore believed to have been obviated.

Claims 36-38, 44-48, 50-58, 61, 62 and 64-69 are rejected under 35 U.S.C. 103a as being unpatentable over U.S. Patent 5,125,741 to Okada et al. in view of U.S. Patent 4,794,265 to Quackenbos et al. The rejection is respectfully traversed as applied to the claims as amended.

As amended, Claim 36 now requires that each of the first and second collector be substantially rotationally symmetrical about its optical axis. As noted in the specification of the present application and referring to diffused light generated by point defects, at least some of the embodiments of the invention "provide a flexible means of selectively separating and further processing the relevant parts of the diffused light, to suit the particular inspection task at hand." Page 13, lines 16-18. The rotational symmetry of the first and second collectors of Claim 36 permits the directional scattering information of the diffused light generated by defects to be preserved so that they can be detected by the arrays of detectors of Claim 36.

Okada et al. fails to teach or suggest the above-described feature of Claim 36. Even though Okada also employs two light collectors, namely a TV camera 5 located immediately above the surface of the specimen under inspection as well as a mirror 7, the mirror 7 is described to be a parabolic cylinder. A parabolic cylinder mirror is clearly not rotationally symmetrical about any optical axis and therefore does not preserve the

directional scattering information inherently contained in the light scattered by the surface that is inspected.

Furthermore, in view of the purpose and optical setup of Okada, it is further believed that there is no reason or motivation for modifying Okada so that the two collectors employed (TV camera 5 and parabolic mirror 7) are both rotationally symmetrical about their respective axes.

Okada employs a vibrating mirror 3 which changes the direction of a laser beam from laser generator 1. The light from vibrating mirror 3 is directed towards a parabolic cylinder mirror 4 so that the light beam being reflected from mirror 4 travels along parallel paths displaced relative to one another and at oblique angles towards the surface of the specimen. In other words, when mirror 3 vibrates, it reflects the laser beam from laser 1 so that the beam scans along a path on parabolic mirror 4. Mirror 4 in turn reflects the laser beam along paths which are maintained to be parallel to one another upon refraction by mirror 4, as the laser beam scans across the parabolic mirror 4. In this manner, the laser beam, after reflection by mirror 4, traces a path on the surface of the specimen 11. The parabolic mirror 7 is then used to collect light from illuminated spot from the laser beam that traces a line on surface of specimen 11. Therefore even though the spot reflects light towards mirror 7 from different positions along the line on the surface of specimen 11, since mirror 7 is parabolic in shape, it is able to collect and focus the light from the various positions of the spot toward the same light receiving surface 12.

From the above, it is clear that Okada employs parabolic mirror 7 in its collection optics essentially as a mirror image of the parabolic mirror 4 in the illumination optics, so as to collect light directed to mirror 7 along parallel paths and originating from different

positions of the illuminated spot along the scanned line on specimen 11. Mirror 7 is chosen to be parabolic in shape so as to be able to focus towards the same light receiving surface 12 the light traveling along parallel paths from the scanned line on specimen 11. For this reason, Okada must employ a parabolic mirror rather than a rotationally symmetric collector for collecting light in its collection optics. If Okada were to employ a rotationally symmetrical mirror instead of a parabolic mirror 7, the light traveling along parallel paths from the scanned line on specimen 11 towards the mirror would not be focused to the same light collecting surface, which would defeat the purpose of the optical arrangement of Okada.

Quackenbos, on the other hand, fails to teach or suggest the use of a first and a second array of detectors. Using arrays of detectors in Claim 36 permits the relevant separated parts of the diffused light to be detected separately. This is not taught or suggested by Quackenbos. Furthermore, in view of the above purpose of Okada's optical setup to be able to focus light scattered along different parallel paths toward the same light receiving surface, there is no reason or motivation to modify Okada's collection optics to be rotationally symmetrical in view of Quackenbos as well. In view of the above, it is believed that Claim 36 is patentable over Okada and Quackenbos.

For reasons similar to those explained above for Claim 36, Claim 57 is likewise believed to be allowable. Claims 37, 38, 44-48, 50-56 and 58 are believed to be allowable since they depend from allowable claims. These claims are further believed to be allowable since they contain features which are not taught or suggested by either Okada or Quackenbos. Thus Claim 39, 40 and 54 add the feature that the illumination beam is polarized. There is simply no disclosure in either Okada or Quackenbos on such

feature and no reason or motivation has been provided by the Examiner why one of ordinary skill in the art would have reason or motivation to modify either Okada or Quackenbos to employ polarized illumination. For reasons apparent from the discussion below, it is further believed that such feature is not obvious in view of Okada, Quackenbos and U.S. Patent 5,585,916 to Miura et al.

Claim 47 adds the feature that the illuminated spot is less than 50 microns in dimensions. Throughout the specification of present application, the importance of the capability for detecting small anomalies is emphasized. In order to detect small anomalies, the inspection system preferably has high signal-to-noise ratio. The size of the illuminated spot is important since it determines the signal-to-noise ratio of the inspection system. If the spot size is large, this means that the detector will detect more background noise, so that it is more difficult to detect small anomalies. Whereas if the nominated spot is small, this increases the signal-to-noise ratio, making it easier to detect small anomalies. Okada fails to teach or suggest such a feature. Furthermore, Okada's system is for inspecting surfaces of metal or glass sheets for use in the field of automobiles or electrical appliances. For such applications, detection of small anomalies is not of particular concern whereas in a semiconductor industry, it is critical for small anomalies to be detected, in view of the continuing reduction in the size of semiconductor devices.

Claim 55 adds the limitation that the illumination beam is provided to the test surface along a path which is substantially normal to the test surface. It is noted that in Okada which is the primary reference, the illumination path is along an oblique angle to the test surface and that the TV camera 5 employed is located immediately above the

surface of the specimen under inspection. The Examiner has failed to provide any reason or motivation and any factual support therefor of why one of ordinary skill in the art would modify Okada so that the specimen is illuminated along a path that is normal to the surface of the specimen, or how this is to be done since the TV camera of Okada would appear to block such path that is normal to the surface of the specimen.

Claims 51 and 56 contain the feature that the detectors in the two detector arrays have different intensity detection thresholds. This is not taught or suggested by Okada. As explained in the specification, since large anomalies give rise to high intensity scattering light whereas small anomalies give rise to low intensity scattering light, the intensity detection threshold of the two detector arrays are set differently so that the two arrays can be optimized for the detection of different size anomalies. This is not taught or suggested by Okada.

The specific collection angles of about 3° to 25° from the line and 25° to 70° from the line in Claims 52 and 61 are not taught or suggested by Okada. As clearly illustrated in Figs. 5A-5C of the present application, the angular collection ranges for the detectors optimize the sensitivity of detection for large and small particles. One factor in optimizing the sensitivity of detection is the collection angle of the detector to the normal. As shown in Fig. 5A, for the same size PSL sphere, the intensity of scattered light at a smaller collection angle to the normal is smaller than that at a larger angle of collection.

Sensitivity of detection is the ability to differentiate a signal originating from an anomaly from that originating from background. Therefore, in addition to accounting for the strength of the light signal from the anomaly, the strength of the background signal

will also have to be taken into account as illustrated in Fig. 5B. As shown in Fig. 5B, it is clear that the scattering background intensity of silicon is much stronger at or near specular collection angles in the range of 2 to 5 degrees as compared to that at large collection angles to the normal such as 65 to 85 degrees or 25 to 65 degrees. Fig. 5C is a graphical plot of the signal-to-noise ratio as a function of sphere diameter for four different ranges of collection angles. Thus, the ranges of angles in claim 52 as well as claim 61 stem from careful analysis of the sensitivity of detection as a function of collection angle to the normal as well the influence of the background signal. Without such study and analysis as taught by the Applicants in this application, those in the art would not be able to choose the particular ranges of angles for detection.

Similarly, the three ranges (3° to 25°, 25° to 65° and 65° to 85°) of Claims 53 and 62 are likewise not taught or suggested by Okada. Without a careful study and analysis as taught by the Applicants in this application, those in the art would not be able to choose such particular ranges of angles for detection.

The Examiner has failed to address the above features of the dependent claims in the office action of March 24, 2004, and therefore failed to make a *prima facie* case of obviousness of these claims. For this reason, if these same claims are rejected in the next Office Action, the next Office Action should not be made final.

Claims 70-75, 76-83, 85-90, 92-102 and 104-108 are rejected under 35 U.S.C. 103a as being unpatentable over Okada in view of U.S. Patent No. 5,585,916 to Miura et al. The rejection is respectfully traversed.

While Miura does teach the use of polarized light for enhancing the detection of certain flaws, the flaws detected by Miura are particles which are radically different from

those detected by Okada. The problem to be solved by Miura is outlined in column 2, lines 10-19 of Miura. When a laser beam is directed towards the surface of the article inspected along an oblique path, interference between light reflected by the surface of the substrates and light directly impinging on the particle may cause intensity of scattered light from a larger particle to be lower than that of scattered light from a smaller particle. This may cause the inspection system to be incapable of detecting the size of the particle accurately. The phenomenon is illustrated further in Fig. 4 and described in column 5 of Miura. Fig. 7 of Miura further illustrates the result of calculation of the intensity of scattered light varying with the incidence angle and the results being plotted with respect to different sizes of particles to show that the signal from a larger particle can become weaker than a signal from a smaller particle. To reduce such interference, Miura employs P-polarized light. See column 6, line 63 through column 7, line 15, referring to Fig. 11.

Okada, on the other hand, is not interested in detecting particles. Rather, it is interested in detecting defects in the surfaces of metal or glass sheets only in the form of flaws, stains, scratches, depressed dimple-like flaws and cracks. See column 2, line 28, column 5, lines 51-52, column 6, lines 9-10 and column 7, lines 49-51. Since Okada is not interested in measuring or detecting particles, but is interested only in detecting or measuring defects other than particles, there is no reason or motivation to adopt use of polarized radiation as taught by Miura in the optical system of Okada, since the use of polarized light in Miura is primarily used to reduce interference effects when particles are detected. We therefore disagree with the Examiner's statement that it would have been obvious to use polarized light as taught by Miura in the system of Okada. The rejection therefore fails, in our opinion.

Some of the rejected claims further distinguish from Okada and Miura on the ground that the first and second collector collect light scattered within different ranges of collection angles that are away from and do not include a line normal to the test surface, as in Claims 71, 79, 87 and 98. Since the TV camera 5 of Okada is placed immediately above the surface of the specimen under inspection, it detects light scattered in the direction perpendicular or normal to the surface of the specimen and therefore has a range of collection angles that includes a line normal to the surface of the specimen, unlike claims 71, 79, 87 and 98.

Okada uses the TV camera 5 for two purposes. It is used to provide a picture image of the specimen surface which image is then used for determining the locations, sizes and nature of surface flaws, defects or cracks and the results of the analysis is displayed on display 10 so that the inspector can easily recognize the nature of defects from the indicated color distribution. See column 7, lines 18-29. As a second purpose, the picture image is used for determining the height of the inspected surface by calculations based on the principle of triangulation. See column 2, lines 52-58 and column 7, lines 38-42. As noted by Okada, "one of the merits of using the TV camera picture image is that it gives information on the three-dimensional shape of the inspecting surface as described hereinbefore, permitting to move the stage 16 up and down to maintain the scanning position of the laser beam at a constant height." See column 7, lines 43-48.

In view of the above goals of Okada, it would be undesirable to modify Okada's optical system so that the TV camera is moved from the location immediately above the specimen to a location on the side. This is disadvantageous because when the TV camera

is moved from the location immediately above the specimen to a location on the side, correction of the picture image taken by the camera will need to be made so that display 10 will display accurately the surface faults, defects or cracks despite the off center position of the camera in order to enable the inspector to recognize the nature of the defects. Furthermore, moving the TV camera to an off center position will make it more difficult to control the height of the surface inspected since this would complicate the calculations based on the principle of triangulation.

Dependent Claims 72-75, 77-83, 85-90, 92-97, 99-102 and 104-108 are believed to be allowable since they depend from a novel claims. They are further believed to be allowable since they add limitations which are not taught or suggested by either Okada or Miura or any other art of record. Claims 72-75, 80-83, 99-101 are believed to be allowable for substantially the same reasons as those discussed above for Claims 52 and 53. Claims 77, 85, 92, 103 are believed to be allowable since it is believed that it would not be obvious to combine Miura with Okada as discussed above. Claims 76, 78, 84, 86, 102 are believed to be allowable since they depend from allowable claims.

Claims 39-40, 49, 76, 84, 91 and 103 are rejected under 35 U.S.C. 103a as being unpatentable over Okada in view of Quackenbos and Miura. The rejection is respectfully traversed.

These claims are believed to be allowable since they depend from allowable claims. Furthermore, Claims 39 and 40 add limitations directed to the use of polarized light. As noted above, it would not have been obvious to one of ordinary skill in the art to combine Miura with Okada.

It is noted with appreciation that claims 41-43 would be allowable if re-written in independent form. This has not been done since the claims upon which they depend are also believed to be allowable.

Claims 36-87 and 89-108 are presently pending in the application. Reconsideration of the rejections is respectfully requested and an early indication of the allowability of all the claims is earnestly solicited.

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Respectfully submitted,

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9/22/04
Date